

AMERICAN VETERINARY REVIEW,

AUGUST, 1889.

EDITORIAL.

ÆTIOLOGY OF TUBERCULOSIS.—The conclusion of this most excellent article—Its translation due to the initiative of the Massachusetts State Veterinary Association—Dr. Koch's letter of authorization—The enterprising spirit of the REVIEW—Expense no obstacle to its publication—Yet it is not so complete as might be wished—Enough shown to demonstrate that the bacillus is the all-important factor—without it no tuberculosis—with it nothing else—The value of the paper to all, pathologists, biologists, students—Minute points of detection described—The pseudo-tubercles cannot deceive any longer. **VETERINARY APPOINTMENT.**—Progress made in the past few years—Position of the veterinarian to-day—That of a few years ago—official appointments—Creation of new veterinary positions—Sanitary science makes it all—Dr. Knowles' recent appointment—His prospects—Our hopes—Need for an official veterinary directory—We are ready for it. **IMPORTANT NOTICE.**—If the REVIEW does not come regularly, we are not always to blame—Help us in the proper delivery. **UNITED STATES VETERINARY MEDICAL ASSOCIATION—IOWA STATE VETERINARY MEDICAL ASSOCIATION**—Annual meeting of both.

ÆTIOLOGY OF TUBERCULOSIS.—The portion of the article of Professor Koch on the "Ætiology of Tuberculosis" which we print in the present number of the REVIEW, forms the conclusion of this able and interesting treatise. For the translation of this paper our acknowledgments are due to the Massachusetts State Veterinary Medical Association, to whose kindness must thus be attributed the opportunity of the English reading public to profit by a study of the ablest dissertation yet written on the subject in question. We improve this opportunity to renew our thanks to the Massachusetts Association, and we must also express our appreciation of the kindness which characterizes the reply of Professor Koch to our solicitation for leave to make use of the translation, as

shown in his letter to that effect, which has been placed in the archives of the Association, and which in the original reads as follows :

(Copy.)

BERLIN, KLOSTER STR. 36.

DER 29 APRIL, 1889.

Hochgeehrter Herr !

Auf die in Ihrem Schreiben vom 31 Marz an mich gerichtete Anfrage, erlaube ich mir Ihnen mitzuthellen, dass ich mich damit einverstanden erkläre, dass die Übersetzung meiner Arbeit über die Ätiologie der Tuberculose durch den Druck veröffentlicht wird.

Mit grosster Hochachtung, ergebenst

R. KOCH.

(Translation.)

36 KLOSTER ST., BERLIN,

APRIL, 29, 1889.

DEAR SIR.

In reply to the request contained in your letter of the 31st of March, I beg leave to say that you have my full authorization for the publication of the translation of my work upon the *Ætiology of Tuberculosis*.

With highest consideration, yours

R. KOCH.

We trust that our readers will not fail to appreciate the zeal which has prompted us in presenting the great work of Professor Koch to the veterinarians of America. The enterprise has not been accomplished without incurring a serious pecuniary outlay, but this consideration has not deterred the REVIEW from taking a step which seemed to be necessary to the fulfilment of the duty, to which we have devoted our time and ability, of laboring for the advancement and elevation of the cause of veterinary instruction in the United States. But, though accomplishing thus much, we have, greatly to our regret, been unable to do to the paper the full justice to which it is entitled. The original is illustrated with many fine plates of which we have been unable to obtain the use, and many references have been, for that reason, necessarily omitted. But, notwithstanding its incompleteness in this respect, the amount of matter we have put in print will more than suffice to prove its value, and to assist other investigators in any researches they may be disposed to undertake.

That the bacillus of Koch is the cause of tubercular disease ; that to these are due all the different lesions of the various tissues in which it is found implanted ; and that it is then in-

variably present, though, perhaps at times, difficult to discover, to color, or to isolate; and that, unless it is *there*, tuberculosis DOES NOT EXIST—all this is proved beyond question or doubt in Koch's "Ætiology." The modes of development, the processes of the biological studies which are required for the investigation; everything discoverable, in fact, connected with this bacillus, are minutely, carefully, and thoroughly described and presented by the author to the inquiring student. With this work properly appreciated and well studied, there is no longer any reason for error of diagnosis in that fatal affection. The lesions are in many instances so characteristic that any error can scarcely be possible, and yet how frequently may it happen that lesions, of the lungs, for instance, often peculiar, may be of a tuberculous aspect and yet entirely different in their nature! The pseudo-tubercles of the lungs, sometimes encountered, have no doubt in some instances led to a diagnosis of alleged phthisis, which would have been of an entirely different nature had the teachings of the author been followed, and the truth discerned, which the absence of the bacilli would have made certain, if it had but been rightly interpreted.

"Ætiology of tuberculosis," which has filled so important a place among German scientific authorities, may now perform the same good office for English-speaking veterinarians, and by such of us as may unfortunately have much to do with this disease in the United States, we hope it will be recognized as an instructor and assistant beyond any possibility of rivalry or cavil, or chance of supercedure.

VETERINARY APPOINTMENT.—The progress accomplished by veterinary medicine in public estimation, and the importance and value of the services which it is now conceded may be rendered by veterinarians in their legitimate sphere—looking over a retrospect of no more than five short years—may be justly viewed with surprise and satisfaction. Within a period a little longer than that no one would have imagined, outside of a dream, the important official positions which veterinarians are now called upon to fill. We well remember the ridicule and derision encountered by an amateur and

lover of veterinary science who, at the creation of a board of health in one of the large cities of the East, suggested the wisdom and advantage of including veterinarians among the number of its appointees. Yet to-day, every board of health, whether of city or of State, which can claim a right to be considered a complete and practicable organization, has its veterinary officers and inspectors, who are indeed their most efficient and influential members and upon whom usually fall the burdens of labor and responsibility, when epidemics occur, or other occasions arise which test the value and demand the interposition, while they illustrate the necessity of the existence, of these extra creations of sanitary precaution.

These remarks are partly *apropos* of the new appointment by the State of Indiana of which we have just heard, of a comparatively recent graduate, Dr. M. E. Knowles, who has been commissioned as State Veterinarian for that commonwealth. Our knowledge of Dr. Knowles authorizes the expression of our confidence in his character and his ability as a young, energetic and competent veterinarian, who will render good service to the State which has honored him. There ought to be published somewhere an authenticated and properly managed directory containing the names of all the State, Territorial and other official veterinarians in the land, and we improve the occasion to request such of our brethren as are occupying such positions, to furnish the REVIEW with their names and addresses for classification and preservation. Reference, professional comity and mutual communication for purposes of common interest and convenience may be greatly facilitated by such a measure. Who will second the motion?

IMPORTANT NOTICE.—We have frequently received complaints of the failure of the REVIEW to reach the proper parties. This would imply on our part a carelessness unworthy of our patronage and a loose manner of doing business that we desire to defend ourselves from. We have, however, made inquiries into the causes of the non-delivery, and in the great majority of cases, have found the following reasons: either an imperfect address; and at times a wrong address; or

no address at all—neither of which errors can be laid at our door. It may be the case of a practitioner who had merely given us his name, town and State, without the county; or one who has moved away and left no directions to the old post-office and certainly none to us; or, and that is *common*, a student who has subscribed while at college and at the time of leaving and returning home has not given us his new address. This we find has been quite commonly the case with many of the students of all the colleges, whether in the United States or in Canada. We can assure our patrons that we are anxious to have them receive their REVIEWS in time, but they certainly ought to help us in so doing. Kindly see that the address on your next REVIEW is correct, and if not, let us have it as it should be.

UNITED STATES VETERINARY MEDICAL ASSOCIATION.—We are asked by Dr. W. Hoskins, Secretary of the above named Association, to announce that the next annual meeting of that body will take place on the 17th of September in the city of Brooklyn. Due notice of the same will be given to all members by the Secretary.

IOWA STATE VETERINARY MEDICAL ASSOCIATION.—We are in receipt of a notice of the second annual meeting of this Association, which is to be held in the parlors of the New Savery House at Des Moines, Iowa. We take this opportunity to thank President S. Stewart and Secretary T. Butler for their kind invitation, and with our best wishes for their Association express our regrets at our inability to be present because of our absence from the country.

ORIGINAL ARTICLES.

ÆTIOLOGY OF TUBERCULOSIS.

By DR. R. KOCH, Privy Councillor.

(Translated by Rev. F. SAURE.)

(*Transactions of the Massachusetts Veterinary Medical Association.*)

(Continued from page 171.)

Twentieth experiment: Of five cats the first received an injection of pure blood serum, died; second the same serum with an addition of reincultur No. 23

(miliary tubercles of man, cultivated for five months in eight successive breedings;) the third from reincultur No. 1 (lung phthisis of man, cultivated for seven months in twelve successive breeds); the fourth from reincultur No. 16 (perlsucht knot, cultivated for five and a half months in nine successive breedings); the fifth from reincultur No. 13 (tuberculosis of monkey cultivated for three months in five successive breedings). Just the same was done with five guinea pigs. Of the last, one each died on the twelfth, fourteenth, fifteenth and twenty-first days. The controlthier was killed on the twenty-second day. Of the cats the fourth died on the twenty-second day, the third on the twenty-seventh day, the other animals were killed on the twenty-eighth day. All the animals into which the bacilli liquid had been injected showed the familiar tuberculous changes in a state of development corresponding with the space of time since the injection. As well the cat as the guinea pig into whose abdominal cavities pure blood serum had been injected, were wholly free of tuberculosis. This experiment, like several previous ones, was undertaken to test any possible differences which might exist in the results of bacilli culturen originating in the various forms of tuberculosis. But this time also the expectation cherished was not fulfilled; for the tuberculosis generated by the various reinculturen conducted itself exactly the same in all, in the cats as well as in the guinea pigs.

Twenty-first experiment: Reincultur from tuberculosis of monkey (No. 11, cultivated for five months in ten successive breedings) was injected into the abdominal cavity of five rats. These animals were fed for some time beforehand with the dead bodies of tuberculous guinea pigs. In the case of other rats which belonged to the same feeding experiment and had been killed, only individual grey knots had been found a few times. But when the rats, into whose abdominal cavity tuberculous bacilli had been injected, were killed, after five weeks, numberless tuberculous knots were found in the lungs, in the greatly enlarged spleen, and in the liver and omentum.

Twenty-second experiment: Reincultur (No. 24, from a phthisic lung, cultivated for five months in nine successive breedings), rubbed up in distilled water, was injected into the abdominal cavity of the following animals; six guinea pigs, three cats, four white mice, four domestic fowls, eight doves. The guinea pigs died in from ten to seventeen days, the cats one each on the fifteenth, twenty-third and twenty-fourth days. The results as found in the dissection were the same as in the other experiments. The mice, fowls and doves, to be sure, remained alive, but were rough, thin, and seemed sick. As they did not recover, they were all killed at the end of ten weeks. The mice showed the same appearance as the white rats; they had quite numerous tuberculous knots in the lungs and very many in the greatly enlarged spleen. In the fowls and doves were found such knots as have already been described in the intestines and in the liver.

INJECTION OF REINCULTUREN IN THE VEINS.

By this method the infection of the animal is wrought most quickly and in the manner most productive of result. The body is at once overflowed by means of the blood with as great a quantity of the infectious matter as one wishes. Said matter has no need to overcome the hindrances put in its way, by the lymph-

glands, etc., as when other methods are used, but spreads itself immediately over all the organs and causes a great and quite uniformly distributed tuberculous eruption. The mode of infection has plainly the greatest resemblance to that of miliary tuberculosis in man, where the tuberculous virus also makes its way into the blood and so is carried everywhere. By the help of injection into the veins tuberculous knots can be called forth in all the organs in such short time, and in so enormous numbers as is never the case in spontaneous tuberculosis; a mistaking of one for the other is therefore here completely excluded. The liquid in which the reinculture of tuberculous bacilli were divided as finely as possible was filtered through fine gauze, in order to keep back all coarser particles, and then injected with one of the formerly described disinfected syringes, into the vena jugularis, or according to Aufrecht's example, direct into the ear-vein of a rabbit which had been laid bare.

Twenty-third experiment: Of twelve rabbits, two had a half cubic centimeter of pure blood serum injected into the ear-vein; four rabbits received in the same manner blood serum with an addition of reinculture No. 11 (tuberculosis of monkey, cultivated for six months in eleven successive breedings—compare the seventeenth experiment); three rabbits blood serum with reinculture No. 1 (from phthisic lung cultivated for six months in ten successive breedings); three rabbits, blood serum with reinculture No. 19 (perlsucht lung, cultivated four months in seven successive breedings). In the first days after the operation nothing striking was to be noticed in any of these rabbits. The two first remained brisk and vigorous, all the others began to breathe hard in the second week, and became emaciated with unusual rapidity. The first rabbit (injection with cultur No. 1) died after eighteen days; the second and third (injection with cultur No. 11) after nineteen days; the fourth (cultur No. 19) after twenty-one days; the fifth (cultur No. 1) after twenty-five days; the sixth and seventh (cultur No. 11) after twenty-six and twenty-seven days; two other animals on the thirtieth and thirty-first days. The last and the two controlthiere were killed on the thirty-eighth day after the injection. In the conduct of the lungs and other organs of the animals treated with the various culture, as in former similar experiments, no distinction could be observed. In all the animals numberless miliary tubercles were found in the lungs. The liver and spleen of all these animals contained an extraordinary number of tubercles. In those which died first the knots were smallest, but also most numerous. It was plain that the great number of tubercles had caused such an early death. In the animals dying later the number of knots was somewhat smaller, but their size, on the contrary, decidedly larger. The two controlthiere were found on dissection without a deposit of tubercles in any organ.

Twenty-fourth experiment: Pure culture of lupus, No. 35 (cultivated for five months in eight successive breedings), rubbed up with distilled water and injected into the ear-veins of five rabbits. These died from the thirteenth to the eighteenth day after the injection and in the dissection showed the same state of things as in the rabbits of the former experiment.

Twenty-fifth experiment: Pure culture of monkey tuberculosis No. 11 (cultivated for six months in twelve successive breedings), rubbed up with distilled water, was injected into the vena jugularis of ten rabbits which were intended for experiments in inhalation with means of hindering the development. They

all died in the course of two to three weeks after the injection and had great quantities of tubercles in lungs, liver and spleen.

The tuberculous knots generated by injection into the course of the blood, like all the other infections brought about by pure cultures, were not to be distinguished from the tubercles arising spontaneously. They contained tuberculous bacilli in greater or lesser numbers and were virulent, for, when inoculated into other animals, as was frequently done, they caused tuberculosis in the same manner as the inoculations with genuine, spontaneous tuberculosis.

INHALATION OF PURE CULTURES OF TUBERCULOUS BACILLI.

In order to bring tuberculous substances into the lungs of animals to be experimented on, either from a tracheotomic wound an injection was made into the bronchia, or the infectious mass suspended in a liquid was made into spray and breathed in by the animals. The first method does not sufficiently correspond with the natural mode of infection, and is complicated in a disturbing manner by the wound necessary for the operation. On that account I have chosen the second method, which to be sure, for evident reasons, is not without danger to the experimenter, and hence demands especial precautions.

The experiment was carried out in the following way: a very roomy box with an opening on one side for the mouth of the atomizing apparatus, was placed in a garden at a sufficient distance from inhabited rooms. The atomizing apparatus was put on the outside of the box and projected with its mouth into the interior of the box. By means of a rubber and a suitably long lead pipe which was put through the wooden framework of a closed window, the apparatus was connected with the rubber bellows, and could so be set in motion from the room without the necessity of the experimenter's venturing within reach of the atomized liquid.

Twenty-sixth experiment: Pure culture from a human phthisic lung (No. 1) cultivated fifteen months in twenty-three successive breedings was rubbed up with distilled water and the liquid so thinned that it appeared almost clear. What visible crumbs were still present in the liquid were deposited after a short rest, and the upper layers of the liquid, showing scarcely any cloudiness, were poured off and used for inhalation. On three successive days, each time in the course of half an hour 50 cctm. were atomized and inhaled by the following animals in the box: eight rabbits, ten guinea pigs, four rats, four mice. After the inhalation the animals were kept in separate cages, and well taken care of. In some animals, in ten days difficulty of breathing showed itself; then three rabbits and four guinea pigs died in from fourteen to twenty-five days. All the other animals were killed twenty-eight days after the last inhalation. All the rabbits and guinea pigs had numerous tubercles in the lungs, varying in size according to the length of time the animal had lived after the inhalation. In the animals dying latest, in those killed there were already tubercles in the liver and spleen. The tubercles in the lungs were in every respect exactly like those which were obtained in guinea pigs and rabbits through inhalation of phthisic sputum in experiments undertaken for other purposes. Especially the tuberculous knots generated by inhalation of phthisic sputum and those generated by the inhalation of pure cultures had that in common, that when they had reached a certain size

their alveolar spreading could already be plainly recognized by the naked eye. They did not appear sharply rounded off and circumscribed, but embraced mostly the centre of a lobulus. As the single alveoli were filled with a caseous mass and hence appeared as fine whitish little points, they had a dull fine-grained appearance, and on their border the white-yellowish little points of the caseous alveoli showed themselves very plainly against the dark, greyish-red circle. The largest tuberculous knots embraced an entire lobulus and sometimes ran together into neighboring knots, in this manner forming larger, thickened, white-yellowish places in the lung which repeated completely the appearance of caseous pneumonia. The spontaneous tuberculosis occurring in rabbits and guinea pigs also shows in the structure of the primary tuberculous knots the conduct just described, namely, the alveolar spreading of the tuberculous process. This circumstance, therefore, confirms the view already expressed, that the spontaneous tuberculosis of these animals is almost exclusively an inhalation tuberculosis.

The rats and mice which were killed had very numerous little grey knots to the size of a hemp seed in the lungs, many of which possessed a white-yellowish centre, yet the caseous degeneration was by far not so advanced as in the lungs of the guinea pigs and rabbits. In the spleen of the rats and mice also, only single grey knots were found. These animals, as has already been often made prominent, are far less sensitive to tuberculosis, the single tubercles develop in them much more slowly, and the further spread of the tuberculosis to other organs does not occur so easily.

Also microscopically the tubercles arising from inhalation of pure cultures resemble completely the genuine tubercles in the arrangement of the epithelioid cells, the giant cells, and the contents in tuberculous bacilli. In order to prove the infectious properties of the same, twenty-two guinea pigs were inoculated subcutaneously in the abdomen with tubercles from various organs, as well from several guinea pigs as from rabbits and from the lung of a rat and of a mouse. These without exception were very soon attacked by swelling of the inguinal glands on the side of the inoculation, became emaciated and died in course of five to eight weeks of tuberculosis.

If we look over all the experiments with pure cultures we reach the following results:

Those animals which belong to species easily susceptible to tuberculosis, namely, guinea pigs, rabbits, field-mice and cats, became tuberculous without exception in consequence of the infection with tuberculous bacilli. The number of these animals amounts to two hundred and seventeen (ninety-four guinea pigs, seventy rabbits, nine cats and forty-four field mice). A number of animals for counter experiments, treated in like manner with indifferent liquids, and kept under the same conditions, on the contrary, without exception, remained free from tuberculosis. Of the less susceptible animals, as a result of a simple subcutaneous inoculation, only domestic fowls, and, moreover, only half of those inoculated, became tuberculous. But even dogs, rats and white mice, which are usually very slightly susceptible to tuberculosis, could not withstand the infection with large quantities of purely cultivated tuberculous bacilli, and also without exception, became tuberculous.

The various methods of infection used had the same effect with the pure

cultures as with the natural tuberculous substances, only the first had a somewhat quicker effect than the last.

The products of the infection also were exactly like those obtained with the natural infectious material, as well in their microscopic structure as in their contents of tuberculous bacilli and in their virulent properties.

By the most careful attention to all the prudential measures needful for the avoidance of mistakes in experimenting with tuberculosis, errors are with certainty excluded from these experiments. With reference to this it may also be made prominent here that in the same manner as with tuberculous bacilli, an extraordinary number of experiments with other disease-producing and non-disease-producing bacteria were made. These were also put into the anterior eye-chamber of rabbits, or were injected into their veins, they were subcutaneously inoculated into rabbits, guinea pigs, mice, etc., and injected into the abdominal cavity. Other bacteria were also used for experiments in inhalation according to the method already described. But tuberculosis was never generated in these animals by these means.

In these experiments made with pure cultures, also only the tuberculous bacilli completely freed from all original products of the disease, can have been the cause of the tuberculosis. The proof of the proposition that tuberculosis is an infectious disease conditioned upon tuberculous bacilli, is herewith concluded. One could be sure to say, and it has been said, that the tuberculous bacilli are one cause for the occurrence of tuberculosis, but that besides these other things, for example other micro-parasites, can likewise generate tuberculosis. This supposition is, nevertheless, erroneous, because as we have seen, in all cases of genuine tuberculosis, tuberculous bacilli occur, and the manner of their occurrence allows us to infer a causative connection with the disease. If in spite of this one would claim that besides the tuberculous bacilli still another special tuberculous virus exist, that would justify a claim that beside trichinæ and itch-mites still another specific, until now unknown agent must exist as infectious material. We can, therefore, with right say that the tuberculous bacilli are not only one cause, but the only cause of tuberculosis, and that without tuberculous bacilli there is no tuberculosis.

Therewith, tuberculosis is joined to inflammation of the spleen in knowledge of its ætiology. The tuberculous bacilli stand in just the same relation to tuberculosis as the inflammation of the spleen bacilli to that disease.

G—THE RELATIONS OF THE TUBERCULOUS BACILLI TO THE ÆTIOLOGY OF TUBERCULOSIS.

The investigations communicated in the preceding have already gained us so much knowledge of the biologic properties of the tuberculous bacilli, and their peculiar behavior in the body attacked by them, that by their help the ætiology of tuberculosis in its outlines may be stated with certainty. In time we shall certainly become more thoroughly acquainted with the properties of tuberculous bacilli, and find out much that is new about them, which will extend our views of the ætiology of tuberculosis, and in many ways amend them; nevertheless, this conviction cannot prevent us from forming

an opinion now as to the relations of tuberculous bacilli to the disease caused by them.

If we start from the experimentally proved proposition that only tuberculous bacilli have the power of generating genuine tuberculosis, and if we apply ourselves to following the way which the bacilli take in the infection, the question of the origin of the bacilli first forces itself upon us. Do they occur anywhere, and independent of the human or animal organism, in the outer world, as for example must be concluded of the inflammation of the spleen bacilli and the micrococci of erysipelas? The answer to this question is of the greatest importance, not only for the ætiology, but also much more for the prophylaxis. For, granted the tuberculous bacilli live in the decaying animal or vegetable materials everywhere to be found, that they can increase and form spores, then it would hardly be possible to keep these parasites away from man. But fortunately it is otherwise. Experience has taught that the tuberculous bacilli grow much more slowly than all other bacteria; further, that they only grow in blood serum and meat liquid, and, which is the main point, they need temperatures of more than 30° C. in order to thrive. Also, when all these conditions were found united, but the tuberculous bacilli were not protected against the luxuriant growth of other quickly growing bacteria, then, as one can often enough see in the cultures corrupted by foreign bacteria, the bacilli would be crowded out and killed by the rival bacteria. Now, indeed, the conditions of development favorable for tuberculous bacilli, especially the warmth of 30° C. day and night for weeks are found united nowhere except in the animal organism, and there is, therefore, no other supposition possible than that they are dependent for their existence wholly upon the animal and human organisms. They are therefore, genuine parasites, which cannot exist without a body to support them. They are not like the anthrax-bacilli, accidental parasites, which usually complete their course of development in the outer world and only occasionally make an invasion into the animal body. There exists also an essential difference between the anthrax-bacilli and the tuberculous bacilli, in that the first only multiply in the animal body, but never form spores, and for the development into the permanent form must get into the outer world again, while the tuberculous bacilli complete their entire course of development in the body and in no way need a life in the outer world in order to take the form necessary for the preservation of the species.

Another question is, whether from the wide-spread bacteria, which often get into the body, under favorable conditions, by means of adaptation and successive breedings, tuberculous bacilli might not arise, or on the other hand the tuberculous bacilli either in the body or after they had left the same might not change into harmless bacteria. It would then not need the invasion of specific bacteria to develop tuberculosis, but all would depend on the necessary preparatory conditions for changing harmless into harmful bacteria, which would be all the same as one usually calls tendency. The representation of a cross-breeding of tuberculous bacilli corresponds exactly with the now often held but widely exaggerated views of the changeable nature of bacteria, and has already found supporters. More value than that of a

purely hypothetical view it can, nevertheless, not claim, for no facts speak for it, but many against it. A certainly proved example of a breeding of harmful bacteria from harmless ones, as is well known, does not yet exist, and there is, therefore, no ground for ascribing to tuberculous bacilli origination of that sort from indifferent bacteria. There is so much the less reason for this, since among the numberless experiments in animals with disease-producing and non-disease-producing bacteria, it has never occurred that in the so very favorable breeding ground of the bodies of rabbits and guinea pigs, tuberculous bacilli have developed from other bacteria. On the contrary, all experiments undertaken with the necessary precautionary measures teach that tuberculosis only arises when genuine, that is to say, complete tuberculous bacilli are united with the animal body.

The relations are different in regard to an eventual weakening of the tuberculous bacilli, since the weakening of the anthrax-bacilli can be cited for the possibility of such a proceeding. Although the possibility of such a change in the virulence is not to be disputed, nevertheless it must be considered that the weakening of the anthrax-bacilli is completed under circumstances which can only be brought about artificially, but which do not come into play in ordinary circumstances either in the body or out of it. Moreover, against such a supposition the fact speaks, that tuberculous bacilli do not show the slightest change in their qualities, especially in their virulence, when successive breedings have been carried on in cultures, that is to say out of the animal body, and on a dead breeding substratum almost two years. Also in the experiments of Fischer and Schill, which are reported in another part of this paper, when tuberculous bacilli had been exposed for six weeks to the influence of decay, no weakening of the virulence occurred. All this speaks with decision against the supposition of an easily occurring change in the virulent properties of the tuberculous bacilli. It is, perhaps, inconceivable that the bacilli did not at some time proceed from other bacteria. But after they had once become genuine parasites, they appeared to have the peculiarity common to other parasites of holding to their qualities with great obstinacy.

The only source for the origin remains, therefore, the animal or human organism, and opportunity is not lacking to these parasites, owing to the extraordinary diffusion of tuberculosis, to reproduce themselves in this field in enormous masses, to develop the permanent form, to get into the outer world, and to attack other victims.

Among the various forms of tuberculosis there are, to be sure, only certain ones which admit an easy transference of the bacilli. But these are exactly the most frequently occurring forms, namely, phthisis and the tuberculous diseases of the domestic animals. The other sorts of tuberculosis play almost no part in reference to infection, partly because they remain so hidden that they can only exceptionally cause infection.

If we ask first in how far phthisis can cause a transference of tuberculous bacilli from diseased to healthy people, it is quite evident that here all the conditions for the spread of the infectious material are present in fullest measure. One only needs to remind himself that on the average one-seventh

of all men die of phthisis, and that most phthisic patients, at least for some weeks, often for months, throw out great quantities of sputum in which enormous quantities of spore-bearing tuberculous bacilli are contained. Of these numberless infectious germs, which are spread everywhere on the ground, on articles of clothing, etc., much the greater part perish again, without ever finding opportunity to establish themselves anew in a living organism. If one farther considers, that according to the experiments of Fischer and Schill already mentioned, the tuberculous bacilli can retain their virulence in a decaying sputum for forty-three days, and in dry air sputum for one hundred and eighty-six days, then with regard to the great number of tuberculous bacilli produced by the phthisically diseased, and to the endurance of the bacilli in a damp as well as dry condition, it is easy to see and explain the enormous diffusion of the tuberculous virus.

As to the method in which tuberculous virus is transmitted from the diseased to the healthy no doubt can obtain. In consequence of shocks from coughing of the diseased person, little particles are rent from the tough sputum, sent into the air and so dispersed like dust. Now numerous experiments have taught that the inhalation of finely dispersed phthisic sputum not only makes those sorts of animals sensitive to tuberculosis, but also those capable of resistance tuberculous with absolute certainty. That man should be an exception to this is not to be supposed. It may, therefore, be taken for granted that when a healthy human being accidentally finds himself in the immediate neighborhood of the phthisically diseased, and inhales particles of sputum sent forth into the air, he can be infected by them. But infection taking place in this manner will probably not occur very often, because the bits of sputum are usually not so small that they can long remain suspended in the air. Far more adapted for infection is, on the contrary, the dried sputum, which, owing to the careless way in which the sputum of consumptives is treated, can plainly get into the air in considerable quantities. Not only is the sputum spit directly upon the ground, there dried and trodden under foot and stirred up in the form of dust, but it often becomes dried and made into dust from the bed clothes, articles of clothing and especially from handkerchiefs, which are soiled even by the most cleanly patients by wiping the mouth after expectorating the dangerous infectious material. The experiences which have been gained from the investigation of the air, with reference to bacteria capable of development, have taught that the bacteria are not suspended in the air in an isolated condition, but that they, with the liquids in which they have grown, dry on the surface of objects and only get into the air when the dried up mass breaks off in little bits, or when the bearers of the dry bacteria liquid themselves are so light that they can be carried away by the lightest breath of air. As such easily moved bearers, little bits of dust act best, which consist of fragments of plant fibres, animal hair, epidermis scales and similar materials. On that account defilement from vegetable tissues and animal hairs and bed clothes; clothing and handkerchiefs, when caused by phthisic sputum are most to be feared. From spittoons and from the floor dried sputum can only be separated in larger particles, which are not easily raised up into the air; on the contrary, one can scarcely conceive a more fav-

orable arrangement for the dispersion of the sputum particles than the rapid drying on cloth, from which with every motion little threads separate themselves, which carry the infectious material into the air, remain suspended comparatively long, and when they finally sink to the ground are whirled up again by the lightest breath of air. The investigations of the air carried on by Hesse are specially instructive on this subject.

As has already been mentioned, the virulence of the dried sputum can be preserved for months; under some circumstances perhaps longer. The last qualities of the virulence depend probably upon its containing well developed spores capable of developing germs. In any case, even if the dried sputum retains its virulence only a few weeks, a consumptive in the condition in which one generally finds these sick persons is very well adapted to provide his immediate surroundings with abundant quantities of infectious material, and, moreover, in the most favorable form for the causing of infection.

When the tuberculous bacilli are inhaled in dust-form, then they can either remain in the upper air passages or force themselves into the alveoli just as is the case with other inhaled particles of dust. The depth to which they enter the respiratory tract will depend essentially on the manner of breathing; if breathed deep and with open mouth, they will get in farthest. Breathing through the nose will, on the contrary, guaranty a certain protection against the entrance of the bearers of the infectious material, since a considerable quantity of dust of the air breathed is retained by the mucous membrane of the nose. But whether the tuberculous bacilli, when they reach the bronchii and alveoli, are able to take firm hold and establish themselves will depend on many circumstances. Especial influence on this will be exercised by the slow growth of the tuberculous bacilli. Other disease-producing bacteria, for example the anthrax bacteria, appear in consequence of their rapid growth to grow very soon to such an extent and to exercise so quickly a harmful influence on the cells in their neighborhood, that the ciliated epithelium of the mucous membrane of respiration is no longer able to master and dispose of them; they can on that account establish themselves in the upper sections of the respiratory passages and call forth the pathological processes peculiar to them. This is taught by the wool sorters' disease and especially the affection running its course under the term of anthrax of the larynx. Quite different are the relations for tuberculous bacilli. These need as many days as the anthrax bacilli hours to reach a development worth mentioning, and before they reach it are in ordinary circumstances usually ejected by ciliary motion of the epithelium long before this. Therefore specially favorable moments must come to make their establishment possible. These are certainly brought about by many conditions. Nevertheless, the most important and most frequent helps for the establishment of the infection appear to be furnished by such diseases as, for example the measles, for a time rob the mucous membrane of respiration of its protecting epithelium, or which furnish stagnating secretions in which the tuberculous bacilli can establish themselves. Also, and that correctly, attention has been called to the fact, that by adhesions of the lungs and imperfect form of the thorax, which hinder a sufficient movement of the lungs and which are especially adapted to cause circumscribed collections of bronchial secretions, the arising of tuberculosis, that is the establishment of

the tuberculous bacilli, is favored. If one makes clear to himself the necessity of such favorable moments for the entrance of the tuberculous bacilli, then it can no longer appear so striking that many persons, in spite of constant association with consumptives, are not infected, while others are plainly infected at the first opportunity, and still others after they have been exposed to the infection for a long time finally, nevertheless, fall a victim to the same. In the case of the first mentioned nothing helped the tuberculous bacilli, which were doubtless often enough inhaled, and they were therefore removed again from the respiratory passages; the second had from the beginning a defective spot in their respiratory organs, on which the bacilli were able to fasten themselves, and it was only necessary that the infectious germ should reach just this spot; the last mentioned not until later had such a defect and lost by means of it to a certain extent their immunity from tuberculosis. The difficulties which stand in the way of the establishment of the tuberculous bacilli in the upper air passages are greater and this fact explains the rare cases in which they primarily become diseased.

Since by far the greatest number of cases of tuberculosis begin in the lungs, it is to be supposed that the infection in all these cases has taken place in the manner just suggested by the inhalation of phthisic sputum dried and made into dust. On account of the immense production of the infectious material and on account of the frequent contact in which it must come with other parts of the human body, it is nevertheless not improbable that the infection can take place from other parts than the lungs. So I would say, that the primary attacks of lymph glands lying on the surface arising from scratches, skin-eruptions, etc., into which tuberculous bacilli have accidentally entered, have formed the entrance gate for the infection, from whence the bacilli have been carried farther and have got into the lymph glands, then when the original point of infection has been healed, it appears as if the disease-process had developed primarily in the glands. A number of cases in which in otherwise healthy human beings caseous lymph glands containing tuberculous bacilli were cut out from the back of the neck, I could not otherwise explain, than that they arose through infection from scratches on the skin of the head. Since the excrement of consumptives not rarely contains tuberculous bacilli, the same is true in regard to the danger of infection from this as from the sputum, when there is opportunity for its drying and being scattered as dust. But this does not occur probably very often; all the same this possibility of spreading the infectious material is to be kept in view.

The second principal source for the tuberculous bacilli, namely, tuberculosis of the domestic animals, appears not to have anything like the importance of the phthisic sputum. The animals, as is well known, produce no sputum, so that during their life no tuberculous bacilli get from them into the outer world by means of the respiratory passages. Also in the excrement of tuberculous animals tuberculous bacilli appear to be only exceptionally present. On the contrary, it is a fact that the milk of tuberculous animals can cause infection. With the exception of this one way, therefore, the tuberculous virus can only have effect after the death of the animal and can only cause infection by the eating of the meat. Aside from the probably only rarely occurring cases of direct infection, which can follow from coming in contact with tuberculous parts of the flesh of little wounds and exoriations of the skin, the reception of the infectious material will result in this

case only by means of the organs of digestion, and in accordance with this the first appearances of the disease must first show themselves here. But now primary tuberculosis of the intestines is not at all frequent in proportion to primary lung-tuberculosis—indeed, a decidedly rare affection. From this it is to be concluded, that the infection in question does not often occur from eating the flesh of tuberculous animals. Probably it would occur frequently if the visibly diseased parts of the flesh were not put aside, as is usually the case, and if, as is almost invariably the case, the meat were not eaten cooked. Also especially it must be considered that the tuberculous eatable animals, especially the *perlsucht* of cattle, remains more or less localized, so that after all only the use of the tuberculously altered lungs, glands, etc., would be dangerous. That, nevertheless, the infection from the intestinal canal is indeed possible, is proved by the frequent cases of secondary intestinal tuberculosis of consumptives, which must be attributed to the swallowing of their own sputa. It is, to be sure, strange that, although it is to be supposed, that every consumptive swallows more or less of the tuberculous bacilli-bearing secretion from his lungs, nevertheless intestinal abscesses are not to be found in all. I explain this in the following manner: In the first place, the intestines appear to offer a still more unfavorable point of attack for the slowly growing tuberculous bacilli than the lungs. But further, the feeding-attempts with anthrax bacilli and their spores, have taught that anthrax bacilli, which contain no spores, are destroyed in the stomach, while the spores of these bacilli are able to pass through the stomach unharmed. On that account only spore-bearing substances can cause infection from the intestinal canal. The tuberculous bacilli will conduct themselves most probably in this regard, like the anthrax-bacilli, and only in case they are provided with spores will cause tuberculosis of the intestines, provided they do not go through the intestinal canal too quickly to render their germinating and establishing themselves at any point of the mucous membrane of the intestines possible. Just the same holds, of course, for the danger of an infection from tuberculous meat, and this circumstance may explain the relatively rare infection from the use of such meat.

The same conditions hold for infection from the milk of cows suffering from *perlsucht*. Before all things, if infection is to take place it is necessary that the milk contain tuberculous bacilli. But this appears only to be the case when the milk-glands themselves are tuberculously diseased. But since *perlsucht*-knots do not often occur in the udder, the milk of *perlsucht* cows will often possess no infectious properties. This explains immediately the contradictions in the statements of the various authors, who have made feeding attempts with milk from cows suffering from *perlsucht*. The one set maintain that they have gained positive results, and their statements are of such a sort that it is impossible to doubt the correctness of their observations. The others, on the contrary, could obtain no infection in the animals experimented with. This result is also correct. The positive results were then obtained from milk which accidentally contained tuberculous bacilli, the negative with milk which was free from bacilli.

If infection from tuberculous domestic animals in general does not appear to be frequent, it must by no means be under-rated. *Perlsucht* of cattle and the caseous changes in the lymph-glands of pigs are of so frequent occurrence that they deserve close attention. If, now, we follow the tuberculous bacilli which

have got into the lungs by inhalation, into the skin by wounds, into the intestinal canal by swallowing, in their further conduct in the body, we see that they often remain for a long time—sometimes even permanently—in the place of their first establishment. From herds of epithelioid cells they form little knots which enclose giant cells, and regularly from the centre out, fall victims to coagulation-necrosis. The appearances which are conditioned upon the gradual growth of such a herd, and the regressive changes which always keep step with it, have been described in detail in a former section. The first sign of the spreading of the tuberculous process into the neighboring regions is the formation of similar knots in the neighborhood of the primary herd. The way, also, in which the migration of the bacilli from the first herd to the place where the secondary knots arise, is to be conceived, I have also already suggested. The following appears to me to be the simplest explanation of this proceeding. The tuberculous bacilli, since they possess no motion of their own, can only be moved along by elements possessing the power of motion, or by currents of liquid. But since the tuberculous knots have no vasal and one cannot see how other liquids, which are in motion, can get into the tuberculous herd and sweep away bacilli from them, nothing remains but the wandering cells, which according to experience, act the same part in other disease-producing bacteria, which those elements perform, that provide for the transport of the bacilli. The cell, laden with a bacillus only goes on until, under the influence of the parasite, it loses its power of motion. On the spot where the cell came to a stand-still, a new tuberculous knot must arise. In this manner groups of tubercles form, which melt, perish and cause destruction in the well-known manner.

With the supposition that the wandering cells may be the bearers of the bacilli, we see in the most natural manner the connection with the farther excursions which the tuberculous bacilli make in the body in almost all cases. When the wandering cell moves in the tissue-passages and must rely on its own power of motion, then the distance which it travels is only a short one and the newly arising infectious herd must lie in the neighborhood of the point of departure. But as soon as the wandering cells move in the lymph-vessels and the lymph-stream comes to their help in their movement, then they travel greater distances, as is seen not seldom in the tubercles spreading themselves out in the course of the lymph-vessels. But very often then the tuberculous bacilli are swept away still farther in the lymph-vessels and led into the nearest lymph-glands, where in like manner as in the first place of infection they call forth the formation of knots and caseous degeneration. The changes conditioned upon this in the gland-tissue appear usually to hinder a further progress of the bacilli by the way of lymph-passages. But by this no insurmountable barrier is placed in the way of the progress of the bacilli. They can, under special conditions, get into the stream of the blood. This happens when, as Ponfick has shown, the tuberculosis attacks the thoracic duct, and reaches the interior of the same; the tuberculous bacilli are then led direct from the lymph-stream into the blood-stream.

A second, and moreover the most frequent cause for the entrance of tuberculous bacilli into the blood, has been discovered by Weigert. This is the formation of tuberculous knots in the walls of veins and the breaking through of the perishing knots into the lumen of the vasa.

A third possibility is suggested in the case described in the earlier pages of this paper, in which the bacilli grew into the lumen of an artery. In all these cases the bacilli were rapidly swept away by the blood-stream, scattered into the most various organs of the body and there established. If very many bacilli at one time got into the blood, then the conditions are exactly the same as in the experiment with the rabbit into whose ear-veins considerable quantities of tuberculous bacilli from a pure culture were injected. As well in the artificial as in the natural experiment, and in the same manner, tuberculous knots arise in great numbers, and moreover especially in the lungs, spleen and liver. Why these organs are so specially favored demands explanation. The connection between the localized tuberculous processes and the acute miliary tuberculosis which formerly appeared so enigmatical, and on that account has been characterized by many as impossible, has been made clear with unquestionable certainty by the discoveries of Ponfick and Weigert. This example of the manifold forms of a disease warns us forcibly against considering pathological changes, and especially infectious diseases, only from an anatomical point of view unless forced to do so, but first of all to consider the aetiological relations as authoritative.

A considerable number of tuberculous bacilli do not always force themselves at once into the blood-passages. It can also occur that only comparatively a few bacilli are carried along by the blood-stream. Then there arise correspondingly fewer tuberculous herds, but which reach greater dimensions because in this case life is longer preserved, than when an immense eruption of tuberculous knots cause rapid death. Also in this matter the infection taking place in the natural way conducts itself just like that artificially generated. Sometimes only a very few bacilli get into the blood and only individual tubercles are formed, which then in course of time grow to considerable dimensions. This proceeding, which can repeat itself with intervening pauses, has been characterized by Weigert very fittingly as chronic miliary tuberculosis, in contrast to the acute, which, owing to the immense production of tubercles is quickly fatal.

To these last mentioned forms of miliary tuberculosis are joined those processes where, in certain places of the body, which are not easily susceptible to an invasion from without and apparently without a herd causing the infection, a tuberculosis confined to the spot is developed. This sort of process, among which the fungous carious infections are to be reckoned, arise strictly localized. One can scarcely explain their occurrence otherwise than that a single infectious germ, therefore a single bacillus, was deposited by the blood on the spot in question. But how is a single bacillus to get into the blood? Could it after being inhaled into the lungs get into the lung capillaries without previously causing in the lung itself a tuberculous herd? Such a supposition has to me little probability. The almost regular appearance of caseous or calcareous bronchial glands in the diseased conditions mentioned rather makes the supposition probable, that the lymph-glands are not always an unconquerable hindrance to the further progress of the bacilli, and that individual bacilli just as they are carried along by the wandering cells and the lymph-stream, can also by help of the wandering cells leave the lymph-glands in centripetal di-

reception again and by the lymph-stream be carried into the blood. I do not doubt that, as in almost every case of miliary tuberculosis, the point of departure for the infection can be shown, one can also succeed in all cases of localized tuberculosis of the inner organs, as well as of the bones and joints, when they are dissected to find some older tuberculous herd, mostly perhaps caseous bronchial glands, from which single bacilli could get into the blood. It is very probable also, that tuberculous bacillar meningitis of children in so far belongs here, as that in the same, although lungs, liver and spleen are very often free from tuberculosis, the bronchial glands are almost regularly found caseous, whence we may conclude that these latter in this case too are to be considered as the primary disease-herd. To be sure it is peculiar, that in this form of tuberculosis, in which plainly not single but numerous tuberculous bacilli are deposited by the blood, the pia mater is so favored a place of deposit.

If, as has already been shown in former parts of this work, the various forms of tuberculosis must be declared identical on account of the same qualities of the bacilli occurring in them and the cultures gained from these, as well as on account of the identity of the inoculating products proceeding from them, the progressive knowledge of their mode of originating gives new proofs of this supposition. At first sight, however different the forms of lung-phthisis, acute and chronic miliary tuberculosis, the affections of the glands and mucous membrane under the general figure of scrofula, tuberculosis of the bones and joints, of localized tuberculosis of single organs, as for example the kidneys and the intestines, may appear, we shall see without difficulty that they belong together when we look at their mode of formation. Only lupus offers in so far a certain difficulty in the identification with tuberculosis, as clinic observation state a distinction that cannot be overlooked in the conduct of lupus and undeniably tuberculous affections of the skin and mucous membrane. Nevertheless the aetiological reasons for the unity of these two diseases are too weighty to retire before this difference, which possibly may find its explanation in the individual disposition.

The relation is similar between the tuberculosis of animals, above all of perlsucht and tuberculosis in man. These also must on account of the identity of the parasites on which they are conditioned, be held to be identical with human tuberculosis in spite of the differences in the anatomical behavior and in their clinical course. It has, to be sure, been stated, especially with reference to perlsucht, that the transmission of this disease to man has not yet been certainly proved. On the other hand the following may be said: On account of the very slow development of the disease, the place and time of the infection and therewith the source of the same can no longer be confidently stated, when the first plain symptoms appear. On this account in the frequent inhalation-tuberculosis the mode of infection can be determined in a scientific manner only in comparatively few cases. Still less will this be possible in the much rarer cases of intestinal tuberculosis arising from the use of flesh or milk of cattle suffering from perlsucht, because here the uncertainty is heightened by the easily possible confusion with other much more frequent kinds of infection. It is therefore very questionable whether ever a case of human tuberculosis can without criticism be attributed to the use of the meat or milk of

tuberculous animals. But if one thinks, that to the most various sorts of animals (cats, rabbits, guinea pigs, field mice) by inoculation with masses of *perlsucht* and the pure cultures gained from them, a disease can be generated with the greatest regularity which anatomically is exactly like the disease caused by inoculation with tuberculous masses, and which kills the animals with the same certainty as the last, then it is not to be expected that man should be an exception to this disease-poison. If in the course of further investigations again a difference between the *perlsucht* and the tuberculous bacilli should show itself, which would compel us to consider the same as only near relations, we should even then have all cause to hold the *perlsucht* bacilli as suspicious in the highest degree. From the hygienic standpoint the same measures must be taken against it as against the infection through tuberculous bacilli, so long as it is not proved that man can bring *perlsucht* bacilli in contact with skin-wounds without danger, that he can inhale the same or bring their spores into his intestinal canal without becoming tuberculous.

The considerable variety in the course of the disease in various individuals of the same species, and in their sensitiveness to the tuberculous virus, appears to speak against a common classification of all the disease-forms conditioned by tuberculous bacilli. These are nevertheless appearances which reappear in more or less marked a manner. One helps himself in this case by supposing a different disposition for the disease, as well as what concerns the attack of the same and its more or less intense course, without that an explanation of the same is given by this characterizing of the appearance. A number of such differences in the form of tuberculosis is already simply explained by the difference of the point of infection. Then the quantity of the infectious material originally taking effect seems to be of essential importance. Single infectious germs are held within bonds more easily and for a longer time by the organism on account of their slower development, so that they remain localized; while, when many germs are imported at once, they support each other in their work of destruction. A definite representation of that which is characterized as individual disposition one can make for all conditions, in which according to our previous supposition, certain favorable moments, such as are afforded by defects in the epithelial covering of the respiratory mucous membrane, stagnating secretions, disturbances of respiration, etc., aid the establishment of the tuberculous bacilli.

If then a large number of the appearances combined under the expression disposition may be referred to simple and easily explainable relations, there nevertheless remain some facts hard to explain, or not to be explained, which compel us to allow the supposition of a disposition to exist for the present. This is above all the striking difference of tuberculosis in its course in children and in grown people; further, the undeniable predisposition of many families for tuberculosis. In the last case many cases of tuberculosis laid at the door of this predisposition might much better be referred to the increased opportunity of infection. One can also think of special predisposing causes belonging to the family character, such as inclination to catarrh of the respiratory organs, defective structure of the thorax. Nevertheless there are many observations relative to this point which do not admit of such explanations. Moreover,

single cases of the disease have already often taught that one and the same person is not at every time an equally favorable subject for the development of the parasites, for, as is well known, it occurs not rarely that tuberculous herds which had reached no slight extent, shrivel, make scars and heal. That is as much as to say that the same body which, at the invasion of the tuberculous bacilli gave a favorable breeding-ground for the same, so that they could increase and spread, gradually loses these favorable properties, changes itself into a bad breeding-ground and so sets a boundary to the further growth of the bacilli. There existed, therefore, in the same person at one time a disposition for tuberculosis and at another time not. Wherein this distinction is founded, whether in a change in the chemical composition of the juices of the tissue, or in physical conditions, that must be taught by later investigations. So much is certain, that such differences exist and there is certainly nothing against the supposition that similar conditions, favorable or unfavorable to the tuberculous bacilli, may exist in certain persons not only for a time, but also during the entire life.

What still concerns the much discussed question of hereditary tuberculosis, after what has just been said, I can express in a few words. No facts exist which justify the supposition that intra-uterine or extra-uterine tuberculous bacilli can be present in the organism of a child, without bringing about visible changes in a comparatively short time. But until now tuberculosis has been very seldom found in the fœtus or in the newly born child, and we may, therefore, conclude that the infectious material has effect only exceptionally during the intra-uterine life. This supposition is confirmed by the fact that of my experimental animals, especially guinea pigs, which not seldom were pregnant before or after the tuberculous infection, none have borne young which were tuberculous at birth. The young coming from mothers tuberculous to a high degree were free from tuberculosis and remained healthy for months. In my opinion hereditary tuberculosis finds its most natural explanation, if it be supposed that not the infectious germ itself, but certain qualities favoring the development of the germs coming into contact with the body at a later period, therefore, that which we call disposition, be inherited.

The ætiology of tuberculosis, as it was here developed on the foundation of our knowledge of the tuberculous bacillus in detail, scarcely offers anything new. Cohnheim had represented tuberculosis as an infectious disease and described its ætiology correspondingly before the discovery of the tuberculous bacillus. In this direction, therefore, my investigations have brought no essential progress to science, and yet it must be considered as a gain that upon the very important question of the infectious nature of tuberculosis, which until then had been disputed by most, now such proofs are furnished as to admit of no reasonable objections. Not less important is it, that the tuberculous bacilli give a sure test of what in the future shall be considered as belonging to the territory of tuberculosis. The diagnosis of tuberculosis will in doubtful cases be made dependent upon the proof of tuberculous bacilli. Practice has, as is well known, made use of this aid to a great extent and moreover with complete success, and has thereby furnished a rich material for proving the correctness of my opinion of the importance of tuberculous bacilli. Already from

this an appreciable advantage has resulted in the discovery of the tuberculous bacillus. But it is to be hoped, that also in other respects something may be gained by it, which can be made useful in fighting the disease. After the experiments already undertaken no great outlook appears to exist in a therapeutic direction, of finding successful means of influencing the parasites in the body of the patient. I would lay so much more value upon the prophylactic measures. These must partly be directed to directly destroying the tuberculous bacilli by suitable methods of disinfection, partly they must strive to preserve the healthy from contact with the tuberculous bacilli in all those conditions in which a reliable destruction of the parasites is not possible.

It appears to me not to be too early to proceed against tuberculosis with prophylactic measures. But owing to the great spread of this disease, all steps which are taken against the same will have to reckon with the social condition, and, therefore, it must be carefully considered in what way and how far one may go on this road without prejudicing the advantages gained, by unavoidable disturbances and other disadvantages. It would lead too far to go into a detailed discussion of the prophylaxis in this place, and I reserve my views in regard to it for another opportunity.

GENERAL LYMPHANGITIS.

An article read before the California State Veterinary Medical Association, December 13, 1888, By DR. J. P. KLENCH, V.S.

There has been, for the last six years, existing among the equine species of California, and more especially amongst the mules, a general constitutional disease, which has proven fatal in nearly every instance, and that has caused death after several months of loathsome suffering and of pitiful distress, unless the owner, having lost confidence in the final curability of the affection, concluded to destroy the animal for the sake of humanity or self-protection.

This affection has not been, to my knowledge, submitted to a diligent study by any practitioner, nor has there been any particular description given of it by the veterinarian authors, with the exception of a few practical records that appeared in some veterinary publication.

I had the good fortune of following several cases in various localities of two counties from the very first start of the disease to the time the animals were destroyed, and took careful notice about the origin and the progress of the symptoms, as well as of the pathological lesions after death. I am

glad to have the opportunity to lay my opinion before a meeting of veterinary surgeons for their critical perusal.

Causes.—The causes are mysterious and can hardly be defined. Up to five or six years ago, this affection was little known, and has perhaps never been noticed before. Long continued rains and a subsequent inundation of the lower lands in all the valleys, caused the atmosphere to be moist, the nights chilly with heavy fogs that seldom cleared away before noon. Then it was that five or six months after that flood, this disease made its appearance amongst the mules of Roberts Island, near Stockton, and all along the tules and rivers, but soon the affection spread over the whole San Joaquin valley, up to the foothills, so that hardly any ranch in the valley was spared. Other localities of the State suffered from the same danger, and from that time until to-day this mule affection appears and disappears in the different counties, and seems to be permanently located in our State. Work, care or feed cannot be accused of having any influence in the development of this disease, as animals have been observed to be attacked while in pasture or at rest in the stable and adjoining corrals, receiving at the time a very substantial nourishment.

The question of contagion might be considered as causative, but must be rejected as doubtful, until evident proofs are brought forward based on direct inoculation. My own experience is rather a proof against the contagious character of the affection, as I will relate it later. In the majority of cases, the disease was in all certainty of a spontaneous origin, and could not be traced to any particular cause by the owner. It seems rather to be due to a special climatic influence, that had the same effect in distant lying localities of the State at the same time.

Physiological works tell us that the secreting organs or glands are far less active in mules than in horses, and daily experience teaches us that in general mules will perspire and urinate less than their equine companions in the same team. A similar fact has been noticed concerning the salivary and intestinal glands. This circumstance explains why mules re-

quire less water for daily use, and why their muscles and tissues are more dense, more hard, more tenacious and resisting. It also tells us why the blood of the mule is less deprived of its impure deleterious elements, and, therefore induces me to consider this impure condition of the blood as a *possible* cause of this disease.

Symptoms.—They are regular in their expression and effect but two modes of eruption. The disease might break out on the legs and the body, or in the upper passages of the respiratory organs. The first indication of the disease will be dullness, loss of appetite and falling off in general condition, which might take place two or three weeks before any other symptoms appear. Swellings will then be noticed on one or several legs, causing lameness, or on any other part of the body; sometimes they affect the upper parts of the limbs more than the lower parts, and generally send out one or several cords to the nearest ganglion. They are painful, more or less œdematous, of firm, but not hard resistance, and will be covered in a few days with numerous lymphatic cords, especially when they are located over the muscular regions of the hind legs, neck and breast. In a few days more these cords, soft on pressure, become knotty: every lump becomes soft, opens and forms a wound, giving exit to yellow-whitish fluid, resembling thick coagulated lymph. Those abscesses located on the lymphatic vessels, evacuate a great amount of fluid, coming from two, four or six more buttons, situated on the same vessel. After the opening of the abscesses, the lymphatic vessels retract, remain soft so that they can hardly be felt. Such buttons as are located on hard underlying tissues, like joints or bones, are small, and situated in the derm of the skin, containing only a little fluid. The tumors on the muscles are located deep, cause a great deal of pain when the animal contracts the muscles, and take eight to ten days to reach the skin. They are large and form a regular cavity. It is noticeable that when a great many abscesses have opened, the animal shows relief, his appetite improves and his movements are easier.

The sores resulting from these abscesses are red, rough,

bleeding easily, with smooth borders injected and swollen, but not indurated, and secrete good matter. Most of the sores will heal and never conglomerate. The smaller sores will cover with a brown sticking crust, upon the removal of which I never noticed the wound to have the tendency to become larger in circumference or deeper at the bottom. The large abscesses on the muscles will, after being opened with the bistoury, often close and fill up again. The fluid running out of the abscesses in vessels always retains the same character, unless farcy complications arrive, as will be shown later. These wounds generally undergo a healing process, and many will cicatrize in the first period of the disease, when the animal is yet possessing his natural strength and vitality, while at a later stage general debility reducing the vital powers, retards and obstructs the cicatrizing process. Especially is this the case when the affection narrows the respiratory passages and seriously interferes with the proper aerization of the blood in the lungs.

It has been observed in all cases that in a few days after the appearance of the first abscesses, more lumps will daily form on different parts of the body and pass through the various stages of tumors, abscesses and running sores, so that in a short time the animal is literally covered with cords, lumps, abscesses and suppurating wounds that give the most disgusting sight one could have of a living animal.

But in the meanwhile complications arise in the form of gangrene in the nasal membrane. This symptom very often appears before the outbreak on the skin and constitutes the second modus of eruption of this disease.

At first there will be a light watery discharge for a few days; nasal membrane is red, congested; then a large brown crust will be seen sticking to the nasal septum, caused by the drying up of the matter secreted from the surface of a large wound; the nasal discharge is heavy, white, foamy, watery, mixed with blood and serosity, of a bad odor or not, falling down without sticking to the borders of the nostrils. Inside of nasal cavity there will be discovered sores of various sizes, from that of a pea to that of two or three fingers, extending

far upwards in the cavity; sometimes parcels of the membrane hanging loose, being only partially detached; the cartilage bare, necrosed, thin, of a dirty bluish-green color, and most often pierced through, opposite the nostrils, so as to cause communication between the two cavities. I am convinced, from my observation, that this destruction of cartilage is not due to ulceration, but was caused by gangrene, due to want of nourishment after all the vessels were destroyed. All these sores are red, injected, with a rough, soft bottom, bleeding easily, with borders congested and tumefied. The membrane of nasal wing is smooth, tumefied, shining and often ecchymotic. Every day the sores are increasing in surface. Sometimes small spots will be noticed, greatly resembling a glandered ulcer, but upon closer examination I could never detect any induration; nostrils are sometimes a little swollen; very seldom does the conjunctive membrane show any modification. Intermaxillary glands are soft, long or very large, painful, irregular, knotty on their surface, two or three glands existing at the same time. All are movable and free of any adherence with bone or skin. Respiration will be very laborious, wheezing on account of the œdema glottidis.

During all this time the animals have a shining, lustrous coat, skin loose and hair smooth and glossy. They eat little and grow poorer from day to day, so that at the end of one month or so, if they are allowed to live, they become entirely emaciated. But some keep up a good appetite and remain in good condition for a long time, having a tolerably fair appearance yet after five or six months.

Post mortem examination.—The following is the correct description of the lesions found in the mule of David Kerr, near Modesto, killed August 1, 1888, with a bullet in the head. An artery was struck, and death was caused from loss of blood, a large solid coagulum of black blood filling the trachea and bronchias. Lungs, liver, spleen and kidneys in a normal condition, perfectly sound. Bronchial ganglion lightly tumefied, two intermaxillary glands swollen, soft, loose, resembling a lymphatic vessel duplicated, full of coag-

ulated lymph. Several buttons in the derm hard, a few of them beginning to soften nasal cavity. Membrane of both sides rotten, gangrened in toto; lower part of septum pierced; cartilage bare to the width of $1\frac{1}{2}$ inch by 3 inches long; parcels of membrane œdematous, congested and ready to sequestrate; here and there a spot more or less wide, having the appearance of an ulcer; but the borders are red, smooth, irregular, not indurated; fold of nasal wing a little œdematous, but membrane smooth and regular. Inferior turbinated bone full of suppuration and partially gangrened or congested; the superior turbinated bone less affected, only a few spots attacked by gangrenous ulceration. In larynx one spot necrosed on the epiglottis; mucous membrane less vascular, but tumefied; small spots of the size of the head of a pin, like beginning of necrosis. All muscles of the body diminished in volume, of black, very black color, the intra-muscular connective tissue very dense, while the adipose tissue between the muscular fascioli is totally absent. A great deal of fat was found outside and between the layers of abdominal muscles; large adipose tissue in the mesentery and around the large intestines as well as on the costal regions. I was surprised to see the intra-muscular absorption so great, while the adipose tissue remained abundant in other parts of the body. In the meantime, the mule appeared, while alive, to be entirely emaciated, and was sick for about five or six weeks.

Diagnosis.—It is very difficult to form a positive diagnosis of this affection on account of its recent origin and its numerous points of resemblance to other diseases, and above all to glanders and farcy. I cannot deny having found many animals that have been suffering for some time where the benign and the malign type exist together, and then the farcinous character becomes the most prominent symptom. In order to avoid too many misunderstandings, I will as briefly as possible describe the typical characters of glanders and farcy. They are represented by buttons, cords, tumors and swellings, which are all at first painful, enveloped in an œdematous infiltration that is absorbed in a few days. Then they become hard, indolent, after that soft, and in two, three or

four weeks will open and form an ulcer. All these lesions pass through the same pathological modifications, and acquire, therefore, a perfectly uniform character common to all glanderous and farcinous lesions. It has been admitted by all veterinary authorities that the morbid element of glanders and farcy is deposited by nature in small spots or noduli, which are found in the skin (farcy), or in the mucous membrane of the respiratory organs, or in the tissue of the lungs or other organs (glanders), and cause a total degeneration of the local tissues, which always will mortify in one piece and then form an ulcer, (when in contact with the air), or become encysted (when in the viscera). The cellular tissue enveloping these noduli is at first inflamed, and in a few days becomes hard, dense, indurated, causing the adherence of all parts concerned, whether it be located around an ulcer, of either nasal cavity or skin, or around a cord, button, or any kind of tumor or gland. This is so reliable and constant a symptom, that I would consider it as the *infallible basis* of all differential characters with other diseases, and state that *whenever this induration does not exist around an ulcer, button, cord, tumor or gland, there is not, nor can there be chronic glanders or farcy.*

The *buttons* have the size of a cent, hickory nut or olive. The large ones are subcutaneous, the lenticular ones are located in the derm and conglomerate. When they are softening, the skin becomes adherent to what remains hard in the button, which is only soft in the centre; the hair falls off and vitality ceasing, the skin mortifies in one piece and the wound produced is an ulcer.

The *cords* are long, flexuous swellings, located in the subcutaneous tissue or in lymphatic vessels, coming especially where large veins run close to the skin, and concentrating generally towards the ganglions. They always start from an ulcer or accidental wound.

The *tumors* are similar to the cords, only of larger dimensions, are found especially on costal and cervical regions. They seldom open and exceptionally form ulcers, but remain soft cavities.

The *ganglions—tumors or glands—*are round, hard, of irreg-

ular surface, adherent and of very dense indurated tissue, which sometimes forms abscesses; in that case, the rest of the gland forms a very hard kernel with an ulcerous, fistulous opening. I will mention yet as a farcinous tumor, the indurated tumor of the testicles and their envelopes, called sarcocèle.

The *swellings* are found in the limbs, affecting one or several joints, and in a short time the whole leg; after the inflammatory period has passed, they become hard and covered with cords and small buttons, and of course later with ulcers. At the same time other cords will emanate from these swellings to the corresponding ganglion. This cordeous appearance is the principal character which will distinguish the farcy swelling from other spontaneous œdemas of the hind legs, but due to different causes.

The *ulcers*.—All the above formations will finally produce ulcers. They are regular, circular, with indurated borders; bottom always shows small indurated granulations of a pale-lead color; they have a tendency to increase in depth and circumference, and are refractory to cicatrisation with a few exceptions. The fluid running out of these abscesses is albuminous, oily, but dries up and forms a brown sticking crust. Often ulcers close to others join together and form one large ulceration.

General appearance.—The hair is staring, without lustre, falling off easy on mane and tail; coat dry, adherent. Soon symptoms appear in the nose, characterizing the chronic glanders.

Nasal cavity.—In light farcy affections nothing might be found in the nasal cavity except a pale colored membrane, but later on a discharge will take place from both nostrils, or but one, and that generally on the left side. The quantity of the nasal discharge is of very little importance, but when the discharge is thick, of a dirty-gray color, mixed with a greenish or sanguineous aspect, and leaving brown crusts, sticking, gluey, attached to the borders of the nostril, it is characteristic of glanders. Nasal membrane pale, of a leaden color or marbled; sometimes, one or several ulcers are noticed on the

septum or under the nasal wing; these ulcers are small, circular like, punched with indurated turned up borders; bottom rough, pale-grayish, indurated, with a tendency to increase. Under the fold of nasal wing, membrane thickened, yellowish or purple, rough, with hypertrophied follicles, and often one or two miliary tubercles, that are very characteristic. Almost in all cases, there is a peculiar unpleasant odor manifested with the expired air, which would recall the odor of a rotten onion. Whenever the disease has progressed so far as to affect the lungs, we will hear a singular cough, dry, short, aborted and never repeating. I used to call it the glandered cough.

The *pathological lesions* after death are many miliary tubercles in the lungs, containing a fibrinous, purulent or calcareous substance according to the period of their formation. Sometimes several tubercles unite, become soft and form a *vomique*. On the inferior border of the lungs can be found an induration of white or grayish, seldom of real color; this also can become soft in the centre and form a *cavern*.

Nasal cavity.—Besides the above lesions already described more or less ulcers or ulcerous erosions. Seldom ulcers penetrate to or through the septum; turbinated bones contain a purulent, thick foetid matter; the osseous lamellæ are deformed and often show one or several ulcerations.

Sinuses.—Mucous membrane thickened and filled with caseous thick matter of bad odor; often ulcers are found in larynx. All farcinous tumors, glands and swellings are formed by dense indurated cellular tissue, hard to cut, and containing a few small abscesses. Lymphatic vessels or cords filled with pus and enveloped by indurated cellular tissue.

In *acute glanders and farcy* we notice farcy buttons and ulcers appearing on the skin at the same time as the glandered lesions in the nasal cavity; all morbid formations pass through their various phases in a few days, and give exit to a yellow fluid mixed with blood; the ulcers produced have irregular borders, reversed, injected and tumefied, bottom red, dead color, secreting a serous-yellowish fluid that seldom dries up or forms crusts; glands swollen, soft, oedematous, free of ad-

herence, often absent; nasal discharge double, thin, yellowish-colored matter and mixed with blood. Nasal membrane injected with a yellowish infiltration or covered with petechial. Nasal ulcers isolated and circular or conglomerated, forming a large irregular wound, borders tumefied and injected; bottom of ulcers granulated, red and bleeding on the lightest friction. Sometimes these ulcerations penetrate to and through the nasal cartilage, establishing a communication of both cavities. All ulcers enlarge in a short time, and between them the nasal membrane is infiltrated with a fibrinous or albuminous substance, that becomes soft and causes mortification of the membrane on a very large surface.

There are always lenticular buttons, that mark a beginning chancre. Acute glanders always causes death in about six days.

(To be continued).

THE MANIA FOR INNOVATION IN THERAPEUTICS.

BY T. W. TURNER, Ph.G.

At no time in the history of medicine have there been so many remedies offered to the medical and veterinary professions as in the present decade. Every new medical discovery is first published in some trade journal, which claims for it superior physiological properties. The recorded cases in which the new remedy may have proved a success are diligently investigated, it is tried wherever possible, the pros and cons of its merit widely discussed, till it is in its turn superseded by something newer, and before much is known about the remedy it is—forgotten.

This constant passion for new therapeutic remedies, which may at times embarrass the professions, sometimes proves a benefit to suffering man and beast. This tendency of the times to produce or invent something new is felt in materia medica as well as in every department of intellectual life. The vegetable remedies, such as roots, herbs, seeds, barks which in former days occupied the most prominent place in pharmacology, have been gradually replaced by the products

of the laboratory. The former have in general a very complicated composition, and possess several active principles, while chemical compounds have a more simple composition, owing to which a more specific physiological action is produced, nor does any undesirable additional activity arise. This overcrowding of the pharmacopœia with new remedies, the topical result of the rapid progress in chemistry, though based on scientific principles, has without doubt its disadvantages. The remedies are examined only by a few investigators, and therefore fail to be sufficiently known in regard to their therapeutical value, and especially to their physiological action.

As soon as the real character of the remedy is partially ascertained, new ones appear, seemingly more valuable, and those of yesterday are cast aside before they have been put fully to the test.

This constant experimenting can hardly be of much benefit to the progress of sound medicine, since it leads to superficial and partially established results. In view of this love of innovation of the present day, the words of Dr. Hufeland, in his work "How to Prolong the Human Life," ought to be well and deeply pondered. He says: "Every sickness is attended with irritation and loss of power. If a remedy influences bodily conditions more than the disease itself, we certainly have restored the patient to health, but he has been more weakened through the process of recovery than he would have been through the action of the disease alone. This is the case nearly always if, in trifling cases, the most powerful and heroic remedies are employed. Diseases may be treated according to different methods and principles. These different methods may all bring a patient back to health; but as regards the prolongation of life, they may be of very different degrees of value. The longer it takes a remedy to effect a cure, the lower the vitality of the system sinks, the more are the powers of the body enfeebled, and the hopes of prolonged life are diminished in proportion to this therapeutic inertia. If, on the other hand, the digestive organs, for instance, are the seat of disease and become

weakened through the action of powerful remedies, or if without necessity the remedy attacks the vital force in general, the more it will weaken the foundation of life, even though it should relieve the disease. Last, but not least, it should not be forgotten that disease at times is nothing else but an effort of nature to eliminate morbid material or to distribute centers of stagnation—an attempt to restore the lost equilibrium. If in such a case the physician tries only to relieve symptoms of the disease, without trying to remove the cause, he opposes the efforts of nature. An ideally perfect remedy should be entirely proportioned to the gravity of the disease. Its action should be such that it does not allow the disease to gain unnecessary headway and so impair the forces of the body that the chances of longevity are diminished. On the other hand, its action should not be too violent, lest while it abridges the course of the disease it is intended to combat, it may light up others, or interfere with the general function of the body, and so seriously affect the prolongation of life.”

EXPERIMENTAL PATHOLOGY.

A RAPID METHOD OF DIAGNOSIS IN GLANDERS.

BY I. STRAUS.

The prompt and early determination of the truth in cases of suspected glanders in the horse is frequently a matter of the first importance, and when the diagnosis is sought for through the inoculation of other animals with the morbid products of the patient, the knowledge of those which possess the highest degree of receptivity and the quickest susceptibility to the infection is of course of the greatest advantage. Among those which are endowed with a special susceptibility in this respect, the donkey is probably entitled to the foremost place, not only because of the promptness with which the inoculation “takes,” but also because of the rapidity of its development after the inception of the disease. But the high value of the donkey in the market practically precludes

its use for such a secondary purpose, and of course it becomes necessary to select some other organism, if not equally available, as nearly so as possible. The rabbit, which has been made the subject of trial, is comparatively valueless for the purpose, the product of inoculation being little more than an insignificant ulcer slow in its development, and not always followed by generalized symptoms. The field mouse has been shown by Messrs. Loeffler and Schutz to be possessed of an excessive sensitiveness to the action of the bacillus of glanders, dying in a space of time varying between two and eight days, exhibiting moreover extensive and characteristic visceral lesions. But it is not always easy to obtain these animals, and as moreover they show a greater susceptibility to septicæmia than to glanders, and as the septic and glanderous elements may become combined, both as to the virus which is injected and the resulting lesions, the result can scarcely be trusted as furnishing any reliable testimony, such as the careful practitioner should always demand, and the field mouse must also be rejected as of no practical utility in the case in hand.

The availability of the guinea pig is next brought to the test. Messrs. Christol and Kiener were the first to experiment with these animals, and to prove their susceptibility to glanders. When inoculated under the skin, they generally die in from twenty-five to fifty days, during which period they not only exhibit the glanderous abscess at the point of inoculation, but also lesions of the lymphatic glands; of the liver; the spleen; the articulations and surrounding tissues; and also, the lesions of the testicles, to which I will now call special attention.

It is ordinarily ten or twelve days after a sub-cutaneous inoculation that the testicles become tumefied, the swelling being at first about the size of a walnut, or even larger; the scrotal skin becoming tense, red and shining, and often breaking and allowing the escape of glanderous pus. This constant elective localization in the testicles in guinea pigs is altogether characteristic of glanders.

When instead of inoculating under the skin, I have introduced the virus into the peritoneal cavity, I have observed

the remarkable fact that the tumefaction of the testicles, instead of showing itself only after eight days, had become well marked as early as *the second or the third day* after the inoculation. On the eighth or tenth it has reached considerable proportions, and death has occurred earlier, generally in from twelve to fifteen, and sometimes in from four to eight days.

The peritoneum and viscera of a guinea pig killed two days after having received a peritoneal inoculation of a small quantity of the culture of the bacillus of glanders, will generally preserve a healthy appearance. But if the tumefied testicles are examined, lesions appear of a nature more advanced and characteristic. Mr. Loeffler has pronounced these lesions to be a glanderous orchitis, or epididymitis, but this is an error, the lesions always beginning in the vaginal sac. From the second day following the intra-peritoneal inoculations, both layers of the vaginal serous tissue are literally covered with a mass of white-yellowish granulations, of the size of a pinhead, and on the third or fourth day these layers become intimately united by a thick, purulent exudate, and rich in bacilli, the scrotum at the same time becoming adherent, inflamed and red.

If the tumor is divided, the testicle proper, as well as the epididymi, are seen to be free from lesions, which do not extend beyond the tunica albuginea, the testicular substance being at the same time perfectly healthy.

Out of forty post-mortem examinations of animals killed by sub-cutaneous or intra-peritoneal inoculations, only two presented testicular lesions. It is not then, as has been believed, an orchitis or epididymitis of a glanderous nature; it is only the testicular envelopes, the vaginal sac, and then the scrotum, which are primitively and exclusively affected. This exclusive *localization* in the serous sac of the testicle is observed in both forms of inoculation, but in the peritoneal it takes place *much sooner*, having been observed even as early as the second day.

This rapid and characteristic localization of the diseased process of glanders upon the testicular envelopes in the guinea pig, may then be utilized in ascertaining the glanderous

nature of a pathological product. All that is necessary is to take as the testing animal, a *male* guinea pig and inoculate him in the peritoneal cavity, and if within two or three days the testicles become tumefied and prominent at the ring, we may by this fact alone feel justified in affirming, almost with certainty, that the inoculated substances have contained the bacillus of glanders.—*Archives de Md. Exper.*

REPORTS OF CASES.

"Careful observation makes a skillful practitioner, but his skill dies with him. By recording his observations he adds to the knowledge of his profession, and assists by his facts in building up the solid edifice of pathological science."—VETERINARY RECORD.

CYCLOPS MEGALOSTOMUS ARCHYNCHUS.

By S. C. ORR, V.S., Manhattan, Kansas.

Editor Review: On the morning of the 20th of June I was called to attend a case of difficult parturition in a mare. Upon examination I found an anterior presentation with a deviation of the head upwards and backwards and the foal dead. After several unsuccessful attempts to bring the head to the proper position, I concluded it would be necessary to perform embryotomy to save the mare. After a long and tedious operation the head and neck were severed from the body close to the shoulders and each removed separately, and the subject of the accompanying cut is what I found. The body was that of a well-formed colt, but the head had the superior maxillæ two inches shorter than the inferior, and the pre-maxilla very rudimentary and entirely cartilaginous, nasal chambers and posterior nares entirely absent, but well-formed pharynx and fully developed velum pendulum palati, so that had it been born alive, existence would have been impossible. The eyes, instead of being in their proper places, were both combined in one large eye located in the center of the forehead. There were two pupils, two distinct lower lids and one upper, and the eye-ball very prominent. As the mare has been kept near the railroad it is thought by some that this strange freak of nature was caused by sudden fright at

the train after night, as the eye somewhat resembles the head-light of a locomotive. The specimen is being prepared for mounting.

AMPUTATION OF THE PENIS OF A GELDING.

By L. C. WAKEFIELD, D.V.S., Montpelier, Vt.

April 10th, 1888, Mr. Gordon, a liveryman, came for me to make an examination of a bay gelding, about twelve years old, which had lately come into his possession. He got him of a stranger and supposed him to be sound until he began to notice a very bad odor from the region of his sheath. Mr. Gordon directed his hostler to cleanse the parts and in doing so found what he called "a large wart" on his penis.

I attempted to make an examination without casting, but on account of the manipulations previously made by the hostler the horse had become very uneasy and resented every attempt at examination; accordingly I cast and secured him for an examination. The odor from the parts being almost unendurable, I washed them first with a solution of potassium permanganate and then with a solution of phenic acid. On examination I found an epithelioma, the size of a turkey's egg, on the inferior surface of the glans penis; the growth had an attachment about an inch in diameter. The whole surface was ulcerated and had a granular appearance and the ulceration seemed to extend into the urethra some distance. That portion of the prepuce that came in contact with the abnormal growth was also ulcerated.

The surface of the growth bled easily when touched. As there were two or three small growths on the superior surface of the glans, I advised the amputation of a portion of the penis, but Mr. Gordon, wishing to have an understanding with the former owner, would not consent to an operation then. So he waited until the 20th of the same month, when I cast and secured the horse for an operation. I disinfected and deodorized the parts as before, and then fastened a cord around the penis just back of the glans and a second one around the base of the free portion of the organ, so that in case the assistant

should lose his hold of this portion of the organ after the amputation, it could be drawn out by the cord. My assistant having a firm hold of the organ with his hand, I first made an incision with my scalpel through the prepuce and urethra about two inches posterior to the glans; I then finished the amputation by ecrasement; considerable hæmorrhage following from the posterior dorsal arteries of the penis, I ligated them with carbolized catgut. To prevent the urethra from closing during the process of healing, I sutured the same from the superior, right and left borders to the corresponding borders of the prepuce, thus bringing a portion of the prepuce over the stump of the organ and forming, as it were, an artificial glans. I first used catgut for the sutures, but that not being strong enough, I substituted silk instead. The parts were cleansed with a three per cent phenic acid solution and the horse was allowed to get up. He was put on a laxative diet; tonics and mild diuretics were prescribed and light exercise given daily. The parts were syringed out daily with the phenic acid solution. The temperature was slightly elevated for three or four days. Urination was performed without difficulty and the wound healed well without any disagreeable odor. At the end of three weeks after the operation, the animal would bring the stump in view and a person ignorant of the case would hardly detect the absence of the glans, on account of the folding of the prepuce over the stump, forming, as it were, an artificial glans. At present the animal is doing his daily work with no appearance of any morbid growth on what remains of the once affected organ.

IMPERFORATE HYMEN IN A MARE.

BY THE SAME.

The subject was a three years old mare. About three months ago the owner noticed what appeared to be a tumor, the size of a turkey's egg, protruding from the vulva, especially after micturation and while going up-hill. The owner thought from the opinions of other horsemen that the mare had a hernia and so called me to examine her. I found that

the tumor was easily reducible and evidently contained some fluid. On replacing the tumor, I found no opening beyond the meatus urinarius, and that the vagina ended in a blind pouch, consequently I diagnosed an imperforate hymen. I drew the hymen to the surface again and opened it freely with a crucial incision. Quite an abundant discharge, yellowish and viscid, came away after the incision was made, which I diagnosed as a part of the vaginal and menstrual discharges which were unabsorbed and had no means of exit. The hymen was a strong and unyielding membrane and nearly as tough as ordinary integument.

IS IT EQUINE SYPHILIS?

By W. R. CLAUSSEN, V.S., Waupana, Wis.

Some time in May I was requested to see a Percheron stallion, property of Mr. R. A. Amherst. On examination I found the penis and prepuce swollen and covered with ragged chancre-like sores, also a slight, inoffensive mucous discharge from the urethra. To my inquiry I was told that the animal the week previous had served twenty-three mares in three days, had appeared all right till that morning, when Mr. R. first noticed the sores and swelling. I felt satisfied the sores must have been in existence for some days, although the man in attendance insisted that the horse was "in the best kind" of shape the evening before. The temperature was normal and the appetite good. I termed the disease chancroid. I have afterwards found in one of Professor Anacker's works, mention of blennorrhæa urethræ. Professor Anacker asserts the disease may be produced by mechanical irritation from excessive coition or by the introduction of some foreign body in the urethra, either from the bladder or from without, first as a simple urethritis, the irritation later on spreading to the glans penis and prepuce. The authorities at my disposition do not mention the disease as contagious only from females to males, but I must regard it as otherwise, for a few, (seven or eight) mares that had been served during the three days previous to my visits to the stable, and the only ones

served after the twenty-three mentioned, were brought to me for treatment in the course of from five to twelve days after I first saw the stallion. My first visit was on Thursday, my second was on the following Monday, and during my stay this time three mares were brought there. Of these two were affected; the third had been served about two weeks before and had no symptoms of disease. None of the twenty-three have been heard from as diseased, so I presume it safe to conclude that the disease was the direct result of urethral irritation brought about by excessive copulation. Of the mares some had a few sores on the vulva and nothing more; in others a scanty, but most repulsive, curdy discharge was established. The animals were successfully treated with mild astringent solutions as a wash and iodoform ointment. Some of the worst looking sores were touched with nitrate of silver. Inwardly was employed the iodide of potassa combined with the fluid extract of stillingia.

EPITHELIOMA OF THE EYE-BALL.

By M. E. O'CONNOR, D.V.S., Denver, Col.

I send you to-day by express a horse's eye, the case of which I believe interesting. The following is the history: On the 25th of June I was called to see the horse, a valuable one. I examined the eye, and found that the growth was on the eye-ball. The owner did not agree with me, as an M. D. to whom the horse belonged before coming into the hands of the present owner, as well as a veterinarian, had treated the eye for about eight months; they both concluded it was on the eye-lid. How they could have come to that conclusion was and is still a mystery to me. I was told that the veterinarian chuckled when he heard of my diagnosis, yet that did not worry me. I told the owner I could do nothing for the horse but remove the eye; he suggested that I should cut away the growth. I did so, casting the horse, and using a five per cent. solution of cocaine, afterwards using the solid nit. argent, in spite of which the growth flourished, and did remarkably well. I told the owner that my treatment was

of no avail. I should have remarked that the growth bled freely on the slightest provocation. He told me to go ahead and do what I thought best, which I might say, was the removal of the eye, as the growth was so large it was impossible for the animal to bring the lids over it. I cast the horse and chloroformed him, removed the eye, with a very little loss of blood, filling up the cavity with absorbent cotton, and tinct. chlor. fer., which I allowed to remain for twenty-four hours. I then removed it and inserted cotton, with a twenty per cent. solution of carbolic acid. I performed the operation on the morning of July 15th and up to date the patient is doing splendidly, eating his bran mash three times a day with nit. potass. $\frac{3}{4}$ ss. in each feed.

ANTIFIBRINE IN VETERINARY MEDICINE.

By O. BONVIOINI.

The experiments here referred to were tried upon thirteen horses suffering with influenza (thoracic form); seven affected with severe angina; one colt sick with suppurative pleurisy, following a pulmonary abscess, and another having rheumatismal polyarthritis. Trials made upon two healthy donkeys had proved that ten grammes of the drug could be given without danger.

With doses varying between eight and ten grammes, the temperature was always lowered, even in the most severe cases. The hypothermia began about one hour after the administration of the drug, and reached its height after three or four hours, remaining stationary for two, three or four hours, and then returning to its original point. Generally, one dose was sufficient to modify the thermic curve for a period of six to ten hours; if a longer effect is desired, a second dose may be given without fear, but this will not produce a new depression of the temperature, and if this has a tendency to rise its elevation is only retarded. During the remissions thus produced by the drug, a well marked improvement in the general state of the patients was observed; collapse or functional disturbances have never been seen. A lowering of the

temperature of two to two and a half degrees is the result of the administration of eight to ten grammes of antifibrine.—*Ercolani*, 1888.

A CASE OF CUTANEOUS PAPILLOMA IN A COW.

BY PROF. VIGEZZI.

The subject of this observation was a two-year-old heifer; the tumors being generalized in almost all the regions of the body, and varying in size from that of a small nut to that of a child's head. The largest warts were removed with the bistoury, the excisions being performed on two different occasions. The total mass removed weighed about eleven pounds. The author suggests some interesting considerations upon the pathogeny of warts and their curious mode of elimination.

In 1871 Richter published a paper containing sundry observations of warts in man, in which he speaks of seeing between the central substance and the periphery micrococci which, no doubt, were the agents of contagion. This case of Richter passed unnoticed, and ten years later, in 1881, Maiocchi discovered in a cow the presence of a special organism to which he gave the name of *Bacterium porri*.

Maiocchi and Piana succeeded in inoculating upon themselves the discharge from the wart of a cow, and Vachette showed the contagiousity of bovine to bovine. This transmission is difficult to reproduce experimentally, and the author obtained no results upon a donkey, a dog, or a goat with warts from the cow.

As to the mode of elimination of the warts, Ercolani has studied them and his conclusions are proved by the researches of Maiocchi. It is the result of an obliteration of the blood-vessels whose internal epithelial coating becomes hyperplastic; sometimes also there is endarteritis and periarteritis, the two processes being two forms of obliterating angioitis.—*Resoconto de la Univ. di Parma*.

EXPERIMENTAL RESEARCHES WITH TETANIGENOUS EARTH.

BY PROF. A. GOTTI.

In a paper read before the Academy of Sciences of Boulogne the author presents the following conclusions:

"Experimental tetanus obtained in animals with tetanigenous earth is identical, from a clinical point of view, with that which results from accidental traumatism."

"In the greatest number of fatal cases of experimental tetanus micro-organisms are found at the point of inoculation, as observed by Nicolaier and Rosenback in traumatic tetanus."

"In the experimental disease passing from one animal to another, the alterations at the point of inoculation are lighter, by diminution or shrinking of the bacillus of Nicolaier, and it becomes more and more difficult to produce the disease by ulterior inoculations."

"And lastly, bacteriological researches in the humors and tissues of animals which have died with the experimental disease, show no retiform or spilliform bacilli, nor any other micro-organisms; the opinion of Rosenback, confirmed by Brieger, as to the action of toxic substances formed at the place of development of the tetanigenous germs is probably, then, the correct one."—*Ercolani*.

CORRESPONDENCE.

CALIFORNIA STATE MEDICAL VETERINARY ASSOCIATION—A
CORRECTION.*Editor Review:*

DEAR SIR.—Editorially in the June number you say our bill has been signed by the Governor. But I am sorry to inform you of your mistake. The bill which we all worked so hard for passed the upper house, where it originated, and also the lower one by quite a majority, when a motion to reconsider was passed and the bill was killed by four votes. And it is only to be regretted that they could not have died with it.

The argument was that it would work a great hardship

on horse owners in the rural districts where no qualified men were available, and they had to rely on the ordinary quack, who knew more than they did(?) and if they were debarred from employing him they were greatly wronged.

We must be contented for two years and then we will try it again and try to profit by past experience.

We have lately organized a local Veterinary Medical Society here. It is very small in numbers, but perfectly harmonious and full of energy. We shall hold monthly meetings for discussions.

A copy of the rules will be sent you as soon as printed.

Yours respectfully,

R. F. WHITTLESEY, D.V.S.

LOS ANGELES, CAL.

SOCIETY MEETINGS.

CALIFORNIA STATE VETERINARY MEDICAL ASSOCIATION.

The quarterly meeting of the Association was held in the Baldwin Hotel, San Francisco, on June 12th, the President, Thomas Maclay, M.R.C.V.S., in the chair. Present, Drs. Klensch, (Santa Rosa), Spencer, (San Jose), Wadam, (Santa Clara), Orvis, (Stockton), McCollum, (Sacramento), Egan, Masoero, Bowhill, Nief, Woodruff and Burns, (San Francisco).

After the minutes of the last meeting had been read a long discussion took place as to the form of certificate to be given to members of the Association.

It was ultimately decided that the President and Dr. McCollum be appointed a committee to draw up a certificate, same to be signed by the President, Vice-President, Secretary and the Examination Committee.

A letter was then read from Dr. Morrison of Los Angeles, proposing Dr. Rowland of Pasadena as a member, and at the same time expressing regret at his inability to be present.

Dr. H. A. Spencer, San Jose, then read the following paper on "Ergotism."*

A long discussion followed as to the effect produced by ergot, and also whether smut or some other fungus could not produce some of the same symptoms. Dr. Thomas Bowhill then read a paper on "The Examination of Horses as to Soundness." It was a very careful, voluminous pamphlet, evidently the result of long and deep research into all the best authorities on that subject, and was productive, of course, of long and keen argument.

*The publication of the paper had to be postponed on account of an excess of material.

State Senator Dixon was made an honorary member for his services in the Senate in favor of the bill promoted by the Association, high compliments being paid him for his assiduity and attention to our interests.

A vote of thanks to the essayists and President terminated the meeting.

A. M. McCOLLUM, V.S., *Secretary*.

ILLINOIS STATE VETERINARY MEDICAL ASSOCIATION.

The regular semi-annual meeting of the Illinois State Veterinary Medical Association was held at the Sherman Hotel, Chicago, Wednesday, June 19, 1889.

Though a busy time for the country practitioners to leave home, enough were out for a quorum, but quite a search was made before one of the sixteen Chicago members could be found to act as a reception committee.

Meeting called at 11:30 A.M., President Williams in the chair.

The attendance for the day was as follows: Drs. A. H. Baker, S. S. Baker, Delavergne, Jinks, Nattress, Page, Ryan, Spangler, Thriepland, Williams, Withers, Pease, C. A. Pierce, Reid and Sayre.

The minutes of two previous meetings were read and approved.

New members were admitted as follows: A. G. Alverson, Ontario, '89, Belvidere; Isaac L. Scott, Ontario, '88, Bloomington; G. G. Clendenning, Ontario, '89, Clinton; H. Thompson, Ontario, '86, Paxton; M. Livingstone, Ontario, '84, Kankakee; A. W. Smith, Ontario, '88, Farmers Cy.

On motion the chair appointed a committee of three on delinquent membership.

An amendment to the constitution was taken from the table and passed, which provides for the election of *associate* members from non-residents of the State.

These members have privileges on programme, equal to active members. The programme for the afternoon was short owing to failure on the part of two essayists. J. F. Pease read "Report of Two Cases of Phosphatic Calculi."

The first case was of a mare that had died from rupture of the stomach and diaphragm after a prolonged sickness. An obstruction was found on post mortem in the duodenum, consisting of a phosphatic calculus the shape of a Holland cheese and weighing four pounds and a quarter.

In the second case many small calculi of similar composition were passed by a mare down from azoturea. Specimens were shown. Analysis had shown the triple-phosphate (of ammonium and magnesium) and mucus, principally. No lime was found.

The paper gave rise to a discussion on symptoms of obstruction, gastric tympany, etc.

Dr. Reid of Decatur, believes the symptom of vomition to be rare after rupture of the stomach.

Dr. A. H. Baker has cases with post mortem corroboration, where vomition occurred after partial or complete rupture of the coats of the stomach.

He believes it can occur after complete rupture, but would limit the possibilities to rupture less than two inches in length.

Dr. Williams believed vomition took place in almost all cases, just prior to rupture.

Dr. Reid and others had seen cases recover after repeated vomition.

The use of the stomach pump was strongly advocated by several members.

Dr. W. L. Williams read a paper on "Transverse Fœtal Development in the Mare." Three cases were cited from his practice.

They gave to the obstetrician the characteristics of the "downward direction of the uterus" of authors.

The cervix was wanting, the vagina long and narrow and the hand met the perpendicular wall of the uterus in front. The fœtuses lay downward and backward below the vaginal wall.

The fœtus must develop as shown by post mortem on one of the three cases, in the transverse position with fore legs in one corner and hind legs in the other, making version very difficult. All three cases terminated fatally.

The name of Prof. T. D. Hinebauch of Purdue University, Indiana, was proposed, and he was elected an *associate member*.

The Association then discussed some alterations in the constitution and proposed to change the June meeting to February. Laid on the table till annual meeting.

The Chairman of the Committee on Legislation being absent it was unofficially announced that the bill before the Illinois Legislature to regulate veterinary practice had failed.

On motion a committee was appointed to obtain the co-operation of the Farmers' Alliances in regard to legislation.

The Association adjourned to meet in Chicago in November.

J. F. PEASE, D.V.S., *Recording Secretary*.

A HORSE'S PRAYER.

By S. R. HOWARD, V.S., Hillsboro, Ohio.

Most merciful master, I beseech thee to withhold not thy hand, neither put far from me pure water and sufficient food, that I may have the strength and power to perform thy will to thy edification and welfare.

Oh! giver of all my pleasure and preserver (?) of my health, be kind to me thy servant, for it is my only desire to serve thee with all my strength, that I may give to thee and thy family their portion in due season.

O mighty driver, I acknowledge and bewail the manifold errors I have from time to time committed, provoking thy wrath and multiplying my unjust chastisements. But believe

me, O thrice puissant holder of the reins, my misdoings were unintentional, for I did not comprehend thy commands.

The remembrance of this is painful unto me. Now, therefore, that I have surrendered my intelligence unto you, O mighty son of their father, why do ye not cease to take false impressions from my actions.

After my punishment, when I hear thy voice, I am nervous and sore afraid, for I know not what to expect. Rotteness enters into my bones, and I tremble in myself that I may rest in the day of trouble.

When thou didst ride forth for thy pleasure, I flew to do thy bidding as an eagle hasteneth to eat. I was swifter than the leopard and more nimble than the grasshopper.

I thank thee thou didst not over-check me to excess. Knowest thou that over five hundred veterinary surgeons of Europe have petitioned and cried aloud as with one voice against it?

O master, now that the sound of my grinding is low; that I look out of the window darkly; that I am almost a pensioner upon thee; that my joints are stiff; that accident and disease have rendered motion painful; that I have almost outlived the period of my usefulness; and my strenght has gone out from me, O, add not unto my misery.

Cast me not out from thy bounty! Turn me not "out to die!" Sell me not to the highest bidder, for a few pieces of silver, for then my every succeeding condition is always worse than the first.

My wretchedness and labor increase in ratio with my accumulation of years, until Mother Nature closes the scene and claims her own, I die and am as water spilt upon the ground and cannot be gathered up.

Yea, I do fear I hope in vain. Should you sell me I shudder at the atrocities I will have to suffer without complaining. For that suffering I do believe I will be adequately compensated after my race is run.

I recognize, master, that I have not the right to live save by thy permission. I never doubt thy wisdom or question thy conduct, but, master, I petition thee use the brush vigo

rously and the comb less. My skin is often seriously injured by the corners of the comb. Behold a short motion back and forth doeth the work aright.

Spare not the brush; for know ye of the eight parts taken into my system, two leave by the skin.

Further my welfare and assist me in husbanding my vitality by thy good help. This will be as grateful in the sight of the God of Nature as if one of your own family were concerned.

Are not my days few? My labor has been bitterly exacted all the days of my life.

Now, I only pray that ye will not sell me, when my days of infirmity draw nigh, but rather permit me to exist a few days, with a small allowance of proper food and I will be content.

My strength has dried up and thou hast brought me into the dust of death. Remember not my errors, but do not forget my good qualities.

So mote it be!

PROPHYLAXY OF RABIES AFTER BEING BITTEN.—From May, 1883, to May, 1889, 1673 persons bitten by dogs affected or suspected of rabies—1487 French, 186 foreigners—were treated at the Pasteur Institute. Of this number 118 had received wounds on the head and face. Six of these patients, four wounded on the head and two on the limbs, became rabid during the treatment; four others died within fifteen days after it. There were then but three failures among 1673 persons treated, or one death out of 554 cases.

Have you a few hours or a few days' spare time occasionally that you would like to turn into money? If so, then write quickly to B. F. Johnson & Co., of Richmond, Va., and they will give you information that will prove to be money in your pocket.